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NATIONAL DAM SAFETY PROGRAM, UPPER WALLACE DAM, (INVENTORY NUMB--ETC(U)
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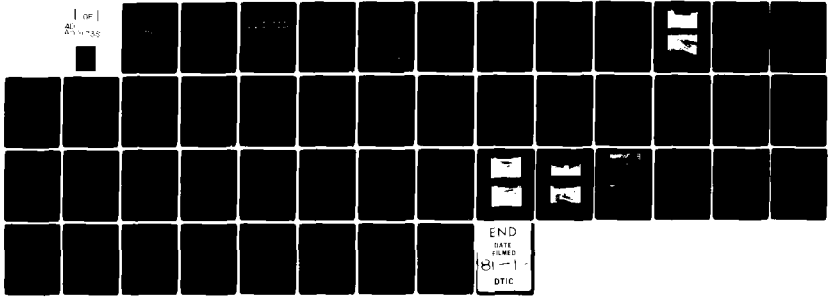

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

POTOMAC RIVER BASIN

**Name Of Dam:** UPPER WALLACE DAM

**Location:** AUGUSTA COUNTY, VIRGINIA

**Inventory Number:** VA. NO. 01516

# PHASE I INSPECTION REPORT
# NATIONAL DAM SAFETY PROGRAM

**PREPARED FOR**

**NORFOLK DISTRICT CORPS OF ENGINEERS**
**803 FRONT STREET**
**NORFOLK, VIRGINIA 23510**

**BY** 80 10 30 067

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

JULY 1980

POTOMAC RIVER BASIN

NAME OF DAM: UPPER WALLACE DAM
LOCATION: AUGUSTA COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 01516

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Upper Wallace Dam,
(Inventory Number VA 01516),
Potomac River Basin,
Augusta County, Virginia.
Phase I Inspection Report.

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
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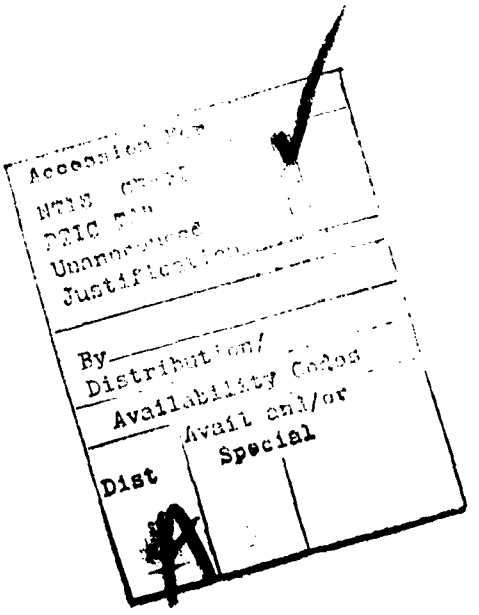
Appendices





# PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Name of Dam: Upper Wallace Dam
State: Virginia
County: Augusta
USGS Quad Sheet: Greenville
Coordinates: Lat 38° 00.1' Long 79° 08.4'
Stream: Poor Creek
Date of Inspection: April 16, 1980

## BRIEF ASSESSMENT OF DAM

Upper Wallace Dam is a homogeneous earthfill structure about 325 ft long and 40 ft high. The principal spillway consists of a rectangular concrete riser and an outlet pipe which extends through the structure. The top of the dam serves as an access road to the Owner's residence with a 10 ft wide gravel surface. An earth emergency spillway is located at the right abutment with a 70 ft wide bottom and 2H:1V side slopes. The dam is located on Poor Creek approximately one mile east of Greenville, Virginia. The lake is for recreational purposes and is owned and maintained by Mr. Gregory Chandler.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the appropriate Spillway Design Flood (SDF) is the ½ PMF. The spillway will pass 80 percent of the Probable Maximum Flood (PMF) or 160 percent of the SDF. The spillway is judged adequate.

An evaluation of the stability condition could not be made since there is no design or construction data for this structure.

The visual inspection revealed several problems. Seepage along the downstream slope and erosion of the upstream slope are both of concern.

The following remedial measures should be implemented within one year of the date of this report:

1) The Owner should engage the services of a qualified Professional Geotechnical Engineer to perform the necessary subsurface investigation and stability analysis to evaluate the stability of the dam and modify as necessary. The effect of the seepage along the downstream slope should also be assessed.

2) An emergency action plan should be developed to warn downstream dwellings of any dangers which may be imminent.

The following routine maintenance and observation functions should be initiated as part of an annual maintenance program.

1) Seepage present along the downstream toe should be monitored quarterly to detect any increase in flow rates which may cause piping within the embankment.

2) Gullies present on the upstream slope should be backfilled and the entire upstream slope of the dam reseeded in order to control surface erosion.

3) The emergency spillway should also be reseeded to establish a good vegetative cover.

4) The roadway across the emergency spillway should receive a surface which will inhibit erosion during overflow conditions.

5) Groundhog burrowing in the embankment should be backfilled.

6) The drain on the intake structure should be repaired and erosion around the outlet pipe should be corrected.

7) Vegetation on the dam should be routinely controlled. Grass and weeds should be cut at least once and preferably twice a year. Small trees should not be allowed to grow on the embankment and should be cut to the ground as they appear.

8) A staff gage should be installed to monitor water levels.

Prepared by:

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

Ray E. Martin, Ph.D., P. E.
Commonwealth of Virginia

Submitted by:

Original signed by
JAMES A. WALSH

James A. Walsh, P. E.
Chief, Design Branch

Approved:

Original signed by:
Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Recommended by:

Original Signed by:
Ronald G. Vann

for Jack G. Starr, P. E., R.A.
Chief, Engineering Division

Date: JUL 2 9 1980

(Looking Upstream From Toe of Dam)

(Looking Across Dam)

OVERVIEW PHOTOGRAPHS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
UPPER WALLACE DAM
VA. NO. 01516

## SECTION I - PROJECT INFORMATION

### 1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (see Reference 1, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

### 1.2 Project Description:

1.2.1 Dam and Appurtenances: Upper Wallace Dam is a homogeneous earthfill structure approximately 325 ft long and 40 ft high.* The top of the dam is 25 ft wide and has a 10 ft wide gravel access roadway to the owner's residence across the length of the dam. Side slopes are approximately 1.5 horizontal to 1 vertical

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* Height is measured from the top of the dam to the downstream toe at the centerline of the stream.

on the upstream face and 1.7H:1V to 2H:1V on the downstream face of the dam. The top of the dam is at elevation 1594 msl (see Plate No. 2, Appendix I). A cutoff trench was constructed beneath the embankment, however, it is not known whether there is a drainage system. There are no foundation drain outlets. The embankment slopes are grassed, however, the slope protection is inadequate on the upstream slope.

The principal spillway consists of a 3.5 ft x 2.5 ft reinforced concrete riser inlet. The riser is connected to a 3.5 ft x 2.5 ft outlet pipe which runs through the dam. The riser crest is at elevation 1580 msl. A 24 inch square sluice gate in the riser at approximately elevation 1556 is used to drain the lake. The outlet pipe has an approximate length of 200 ft with an invert elevation at the outlet structure of 1555 msl.

An emergency spillway is located at the right abutment with a crest elevation of 1584 msl. The emergency spillway is 70 ft wide, sparsely vegetated, trapezoidal earthen channel with 2H:1V side slopes, and is in a cut section.

1.2.2 Location: Upper Wallace Dam is located on Poor Creek approximately one mile east of Greenville, Virginia (see Plate No. 1, Appendix I).

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of the height of the dam.

1.2.4 Hazard Classification: The dam is located in a rural area, however, based upon the downstream proximity of several homes located several miles downstream, the dam is assigned a "significant" hazard classification. The hazard classification used to categorize a dam is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: Mr. Gregory Chandler, Route 662, Greenville, Virginia 24440 owns and operates the dam.

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was designed and constructed under the supervision of the previous owner, Mr. Hal M. Wallace, Staunton, Virginia. The structure was constructed by Omen Construction Company and completed in either 1967 or 1968.

1.2.8 Normal Operational Procedures: The principal spillway is ungated, therefore, water rising above the crest of the riser inlet is automatically discharged downstream. Normal pool is maintained at elevation 1580 msl at the crest of the riser. Flood discharges which cannot be absorbed by storage and the riser, flow through the emergency spillway at pool elevation above 1584 msl.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The drainage area is 3.70 square miles.

1.3.2 Discharge at Dam Site: Maximum known flood at the dam site occurred in April 1977 and an estimated pool elevation of 1585 was observed. The estimated discharge was 400 CFS.

Principal Spillway Discharges:

Pool Elevation at Crest of Dam (elev 1594) 243 CFS

Emergency Spillway Discharges:

Pool Elevation at Crest of Dam (elev 1594) 11,294 CFS

1.3.3 Dam and Reservoir Data: See Table 1.1, below:

TABLE 1.1 DAM AND RESERVOIR DATA

| Item | Reservoir | | | | |
|---|---|---|---|---|---|
| | | Storage | | | |
| | Elevation feet msl | Area Acres | Volumne Acre Feet | Watershed Inches | Length Miles |
| Crest of Dam | 1594 | 40 | 660 | 3.3 | .6 |
| Emergency Spillway Crest | 1584 | 25 | 360 | 1.8 | .55 |
| Principal Spillway Crest | 1580 | 20 | 240 | 1.2 | .5 |
| Streambed at Downstream Toe of Dam | 1554 | - | - | - | - |

## SECTION 2 - ENGINEERING DATA

2.1 Design: There is no design data available. Design data was initially developed by the Augusta County SCS Office (Staunton), however, the original owner (Mr. Hal M. Wallace, Jr.) did not adhere to the design with regard to slopes, spillway, core, concrete work, compaction requirements, etc.

According to Mr. Wallace the following modification were incorporated during construction:

a. The upstream and downstream slopes were steepened to 1.5H:1V and 2H:1V, respectively.

b. The structural height was increased by 3 ft±.

c. A clay core which extended 4 ft± above the original ground surface was included. The underlying core trench was excavated with a backhoe to a depth of 10 ft± beneath the entire structure. Some rock was encountered in the core trench.

2.2 Construction: No construction records are available. The dam was reportedly constructed in a 4 day period under the full time direction of Mr. Hal M. Wallace, Jr. The dam was constructed by Omen Construction Company, who was at that time working on nearby Interstate 81 project. The clay core was constructed with "red clay", while the

remainder of the embankment was constructed with "yellow clay and rock". Materials were obtained from surrounding hillsides and the emergency spillway. Fill was placed in 3 to 4 ft lifts and compacted with loaded pans and possibly a sheepsfoot roller. Compaction around concrete works was reportedly by "wetting" or water placement. Representatives from the Augusta County SCS Office and State Health Department observed part of the construction. The dam was completed in either 1967 or 1968.

2.3 Evaluation: There is insufficient information to evaluate foundation conditions and embankment stability.

## SECTION 3 - VISUAL INSPECTION

3.1 Findings: At the time of inspection, the dam was in fair condition. Field observations are outlined in Appendix III.

3.1.1 General: An inspection was made 16 April, 1980 and the weather was cloudy and windy, with a temperature of 39° F. The pool and tailwater levels at the time of inspection were 1580.5 and 1556.2 msl, respectively, which correspond to normal levels. Ground conditions were damp at the time of the inspection. No previous inspection reports were available.

3.1.2 Dam and Spillway: The downstream and upstream embankment slopes and portions of emergency spillway were grassed (1 to 2 ft high) and included scattered cut brush and briars. Seepage was observed along the downstream toe in two general areas. One area consists of saturated ground extending to a point 35 ft± left of the outlet pipe and varying from 2 to 5 ft± above the pipe. Some iron staining was present, but no flow was observed. Another area consisted of two coalescing wet spots located from 65 to 95 ft± right of the outlet pipe and from 3 to 9 ft± above the pipe. Again, the ground was saturated, but no flow or iron staining was observed. Seepage and heavy iron staining were observed along the plunge pool. Flow estimated up to 1 gpm and iron staining were noted in a 15 ft wide area immediately to the right of the outlet pipe, along the 3 ft± high perimeter slope of the pool. Intermittent iron staining was also noted in a 40 ft± long section of the left side of the plunge pool from

the vicinity of the outlet pipe and extending downstream. The field sketch in Appendix III illustrates the areas described.

Some erosion was observed around the outlet pipe (principal spillway). The downstream slope (1.7H:1V to 2H:1V) was well vegetated and essentially free of erosion. The steeper upstream slope (1.5H:1V) was not as well vegetated and included numerous steeply eroded gullies up to 2 ft in depth. These gullies generally occurred from 3 to 5 ft above pool level down to the lake. One groundhog hole was observed approximately 10 ft below dam crest and 100 ft± left of the right abutment.

No bedrock was observed at the site. The right abutment and spillway consist of silty clay (CL) with a thin veneer of alluvial/colluvial gravel and boulders. Left abutment consists of fine to coarse sand, trace to some silty clay (SM to SC) with gravel and boulders. The embankment appears to be constructed with SM, SC and CL soils with varied amounts of gravel and boulders. Local geology appears to consist of alluvial/colluvial soils overlying residual limestone clays and silty clays. No faults were encountered during the inspection.

The intake structure was partially submerged. The drain gate was reportedly not operational as previous attempts to open the drains were unsuccessful. The 3.5 ft x 2.5 ft outlet pipe showed no signs of deterioration and the outlet pool indicated signs of erosion around the perimeter. The emergency spillway lacked vegetative cover and the access road across the dam and emergency spillway was of stone and soil construction.

3.1.3 Reservoir Area: The reservoir area was free of debris and the perimeter was wooded. The reservoir is located in a valley with side slopes at approximately 2H:1V. No sediment buildup was observed.

3.1.4 Downstream Area: The downstream channel consists of a 5 ft wide channel located in a wide valley with side slopes of 3:1. The channel intercepts Lower Wallace Lake approximately 500 ft downstream. Approximately two miles downstream there are several homes about 15 ft above the streambed.

3.1.5 Instrumentation: No instrumentation (monuments, observation wells, piezometers, etc.) was encountered for the structure.

3.2 Evaluation:

3.2.1 Dam and Spillway: Overall, the dam was in fair condition at the time of inspection. Based upon the appearance of the dam and amount of vegetation growing on the embankment at the time of the inspection, it would appear that some type of maintenance program exists for this structure. Since a routine maintenance program does not exist, it is recommended that one be initiated. The embankment, including its crest, slopes, and emergency spillway should be mowed at least once a year, but more preferably twice a year. Small trees should not be allowed to grow on the embankment and should be cut to the ground as they appear.

The wet spots and iron-stained seepage encountered along the downstream slope represent seepage through the dam. No turbidity was noted during the inspection. This does not present a hindrance to the normal functioning of the dam, however, it is recommended that the seepage along the downstream slope be monitored quarterly to detect any increase in flow rates which may cause piping within the embankment. If increased flows should occur, a Professional Engineer with expertise in Geotechnical Engineering should be contacted to evaluate the problem and make recommendations for required corrective measures.

The shallow gullies described on the upstream slope appear to be the result of surface runoff. Although they do not presently create an unsafe condition, future erosion could be detrimental. It is recommended that these gullies be backfilled and the entire upstream slope reseeded in an attempt to minimize surface erosion. The groundhog hole does not presently create an unsafe condition, however, future burrowing can result in numerous voids in the embankment which could be potentially hazardous under certain conditions. It is recommended that the existing hole be backfilled and that any future burrows be backfilled as they appear.

The outlet pipe and intake structure are in good structural condition. Erosion at the outlet pipe plunge pool should be corrected. The drain on the intake structure is in need of repair. The emergency spillway should be reseeded to establish a good vegetative cover and the roadway across the emergency spillway should receive a surface which will inhibit erosion.

A staff gage should be installed to monitor pool elevations.

3.2.2 Downstream Area: A breach in the Upper Wallace Dam would pass over the Lower Wallace Dam during periods of peak flooding and present a hazard to the downstream dwellings.

## SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Upper Wallace Lake is used for recreational purposes. The normal pool elevation is maintained at elevation 1580 msl, which is the crest of the principal spillway. Water automatically flows through the principal spillway as the pool level rises above elevation 1580 msl. Water will also be automatically discharged through the emergency spillway when the pool level rises above elevation 1584 msl.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the Owner. Maintenance consists of inspection, debris removal, mowing of the vegetative cover, and repair. There is no routine maintenance program. The operating appurtenances are not in working order.

4.3 Warning System: No warning system exists.

4.4 Evaluation: The operating appurtenances are not in working order and should be repaired. Otherwise, the dam is in satisfactory condition. Maintenance of the dam is adequate. A routine maintenance program should be established and complete records of maintenance and inspections should be maintained for future reference. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a) How to operate the dam during an emergency.

b) Who to notify, including public officials, in case evacuation from the downstream area is necessary.

## SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: No hydraulic/hydrologic data is available.

5.2 Hydrologic Records: There are no records available.

5.3 Flood Experience: An estimated maximum pool elevation of 1585 occurred in April 1977 and the estimated discharge was 400 CFS.

5.4 Flood Potentials: In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. The Probable Maximum Flood (PMF), ½ PMF and 100 year flood hydrographs for the area below the South River Dam (located approximately one mile upstream) were developed by the SCS method (Reference 4, Appendix IV). Precipitation amounts for the flood hydrographs of the PMF, ½ PMF and 100 year flood are taken from U.S. Weather Bureau Information (References 5 and 6, Appendix IV). Appropriate adjustments for basin size and shape were accounted for. Discharges for the South River Dam were taken from data supplied by the Corps of Engineers as a result of their Phase I investigation of the dam. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulations: For routing purposes, the pool at the beginning of flood was assumed to be at elevation 1580 msl. Reservoir stage-storage data and stage-discharge data were determined from field measurements and USGS quadrangle sheets. Floods were routed through the reservoir using the principal spillway discharge up to a pool storage elevation of 1584 msl, a combined principal and emergency spillway discharges for pool elevations above 1584 msl, and non-

overflow section discharges for pool elevations above 1594 msl.

5.6 Overtopping Potential: The predicted rise of the reservoir pool and other pertinent data were determined by routing the flood hydrographs through the reservoir as previously described. The results for the flood conditions (100 year flood, ½ PMF and PMF) are shown in the following Table 5.1.

TABLE 5.1 RESERVOIR PERFORMANCE

| | Normal Flow | Hydrograph | | |
|---|---|---|---|---|
| | | 100 Year | ½ PMF | PMF |
| Peak Flow, CFS | | | | |
| Inflow | 3 | 507 | 5216 | 14744 |
| Outflow | 3 | 97 | 5168 | 14314 |
| Maximum Pool Elevation Ft msl | - | 1581.8 | 1589.2 | 1595.2 |
| Non-Overflow Section (Elev 1594 msl) | | | | |
| Depth of Flow, ft | - | - | - | 1.2 |
| Duration, Hours | - | - | - | 2 |
| Velocity, fps (a) | - | - | - | 4.5 |
| Emergency Spillway (Elev 1584 msl) | | | | |
| Depth of Flow, ft | - | - | 5.2 | 11.2 |
| Duration, Hours | - | - | 16 | 28 |
| Velocity, fps | - | - | 12.8 | 18 |
| Tailwater Elevation, Ft, msl | 1554.5 | 1557.1 | 1561.6 | 1564.1 |

(a) Critical velocity at control section

5.7 Reservoir Emptying Potential: A 24 inch square gate at elevation 1556 ft msl is capable of draining the reservoir through the outlet culverts. Assuming a 4 CFS inflow, the reservoir can be lowered to elevation 1557± msl in 3 days through this drain gate.

5.8 Evaluation: The U.S. Army, Corps of Engineers guidelines indicate the appropriate spillway design flood (SDF) for an intermediate size significant hazard dam is the ½ PMF to PMF. Because of the risk involved, the ½ PMF has been selected as the SDF. The spillway will pass 80 percent of the PMF (160% of the SDF). During the SDF the maximum depth of flow in the emergency spillway is 5.2 ft at a maximum velocity of 12.8 fps.

Hydrologic data used in the evaluation pertains to present day conditions with no consideration given to future development.

## SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam is located along the eastern edge of the Valley and Ridge Physiographic Province of Virginia. The impoundment and structure are underlain by the Conococheague Formation of upper Cambrian Age. This formation consists basically of bluish-gray limestone and light gray dolomite with interbedded thin sandstone. Overturned beds exposed west of the site, strike to the northeast and dip from 60 to 85 degress to the southeast. No bedrock or faults were observed at the site. Alluvial or colluvial soils consisting of silty sands and silty clayey sands (SM to SC) with variable amounts of gravel and boulders are exposed in the adjacent hillside and abutments. Underlying residual silty clays (CL) are exposed in lower lying cuts, including the emergency spillway.

Subsurface data is not available for the structure. A cutoff trench exists beneath the dam, and is reported to be about 10 ft deep. Based upon examination of surrounding hillsides and cuts, it would appear that the dam rests upon fine to coarse sands, silty sands and silty clayey sands with variable amounts of gravel and boulders ranging from low to medium permeability. These materials are alluvial and possibly colluvial in origin and their matrix would probably classify as SM to SC in accordance with the Unified Soil Classification System. Underlying residual soils probably consist of silty clays and clays possessing very low permeabilities.

A core trench approximately 2 to 3 ft wide and 10 ft deep was excavated during construction. Rock was encountered intermittently in the trench. The trench was filled with red clay and a core constructed to a height of about 4 ft above the existing ground surface. Gradual consolidation of underlying soils would be expected during application of fill materials. The underlying soils probably had essentially fully consolidated under the applied load not long after completion of construction. Based upon the performance history of this dam, a stable foundation is assumed.

6.2 Embankment:

6.2.1 Materials: Other than verbal discussion with Mr. Wallace, no information was available on the nature of the embankment. materials. The core was probably constructed with low permeable silty clays (CL) of residual origin. The majority of the embankment appears to be constructed with assorted combinations of sand, silt and silty clay ranging from SM to SC in composition and including an indeterminant amount of gravel and small boulders. Low to medium permeabilities are likely for these materials. The fill was reportedly placed in 3 to 4 ft thick lifts and compacted with loaded pans. Mr. Wallace could not recall if a sheepsfoot roller was also used during compaction. Fill around concrete structures and pipe was compacted by application of water.

6.2.2 Subdrains and Seepage: There is no known subdrainage system. No toe drain outlets were observed. Saturated or wet areas encountered along the downstream represent seepage through the dam.

6.2.3 Stability: There are no stability calculations for this structure. The dam is 40 ft high and has a crest width of 25 ft. The upstream slope is about 1.5H:1V, while the downstream slope varies from 1.7H:1V to 2H:1V.

Since the dam does not include a continuous clay core and the presence of a permeable outer shell of SM to SC material cannot be confirmed visually, it is assumed the structure is homogeneous and constructed with SC to CL soils. The dam is not subjected to a rapid drawdown since the drain in the intake structure is inoperable. According to the guidelines presented in Design of Small Dams, U.S. Department of the Interior Bureau of Reclamation, for small homogeneous dams, with a stable foundation, not subjected to rapid drawdown and composed of SC to CL materials, the recommended slopes range from 2H:1V (SC) to 2.5H:1V (CL) for the downstream slope and from 2.5H:1V (SC) to 3H:1V (CL) for the upstream slope. A crest width of about 18 ft is specified. Based upon existing slopes of 1.5H:1V for the upstream slope and 1.7H to 2H:1V for the downstream slope, both slopes are considered to be inadequate. The crest width is adequate based upon the above guidelines.

6.2.4 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: An accurate check on the stability of this structure cannot be made since there is no design and construction data. Erosion due to overtopping is not considered a problem since the spillway will pass the SDF. Foundation conditions are not known and the embankment slopes do not meet the requirements recommended by the U.S. Bureau of Reclamation for small homogeneous earthfill dams on stable foundation. Therefore, it is recommended that the Owner have a qualified Professional Engineer with expertise in Geotechnical Engineering perform a stability analysis in order to evaluate the safety of the dam. Since no undue settlement, cracking, or sloughing was noted at the time of inspection, it appears that the embankment is adequate for maximum control storage with water at elevation 1584 msl. As previously stated, the saturated areas observed along the toe of the downstream slope are believed to represent seepage through the embankment. It is recommended that these areas be monitored quarterly to detect any increase in flow rates, which could result in piping through the embankment.

## SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The Upper Wallace Dam at the time of inspection was in fair condition. The appropriate SDF for this dam is the ½ PMF. The spillway will pass 80 percent of the PMF (160% of the SDF) without overtopping. The spillway is judged adequate.

There are no design or construction records available for this structure, therefore, an accurate check on its stability cannot be made.

Maintenance of the dam is considered adequate.

7.2 Recommended Remedial Measures: The following remedial measures should be implemented within one year of the date of this report:

7.2.1 The Owner should engage the services of a qualified Professional Geotechnical Engineer to perform a subsurface investigation and stability analysis in order to evaluate the stability of the dam and modify as necessary. The widespread seepage observed along the downstream slope should be assessed in this study.

7.2.2 An emergency action plan should be developed to warn downstream dwellings of any dangers which may be imminent.

7.3 Required Maintenance and Observation:

7.3.1 Seepage present along the downstream toe should be monitored quarterly to detect any increase in flow rates which may cause piping within the embankment.

7.3.2 Gullies present on the upstream slope should be backfilled and the entire upstream slope of the dam reseeded in order to control surface erosion.

7.3.3 The emergency spillway should be reseeded to establish a good vegetative cover for erosion protection.

7.3.4 The roadway across the emergency spillway should receive a surface which will inhibit erosion during overflow conditions.

7.3.5 Groundhog burrowing in the embankment should be backfilled.

7.3.6 The drain on the intake structure should be repaired.

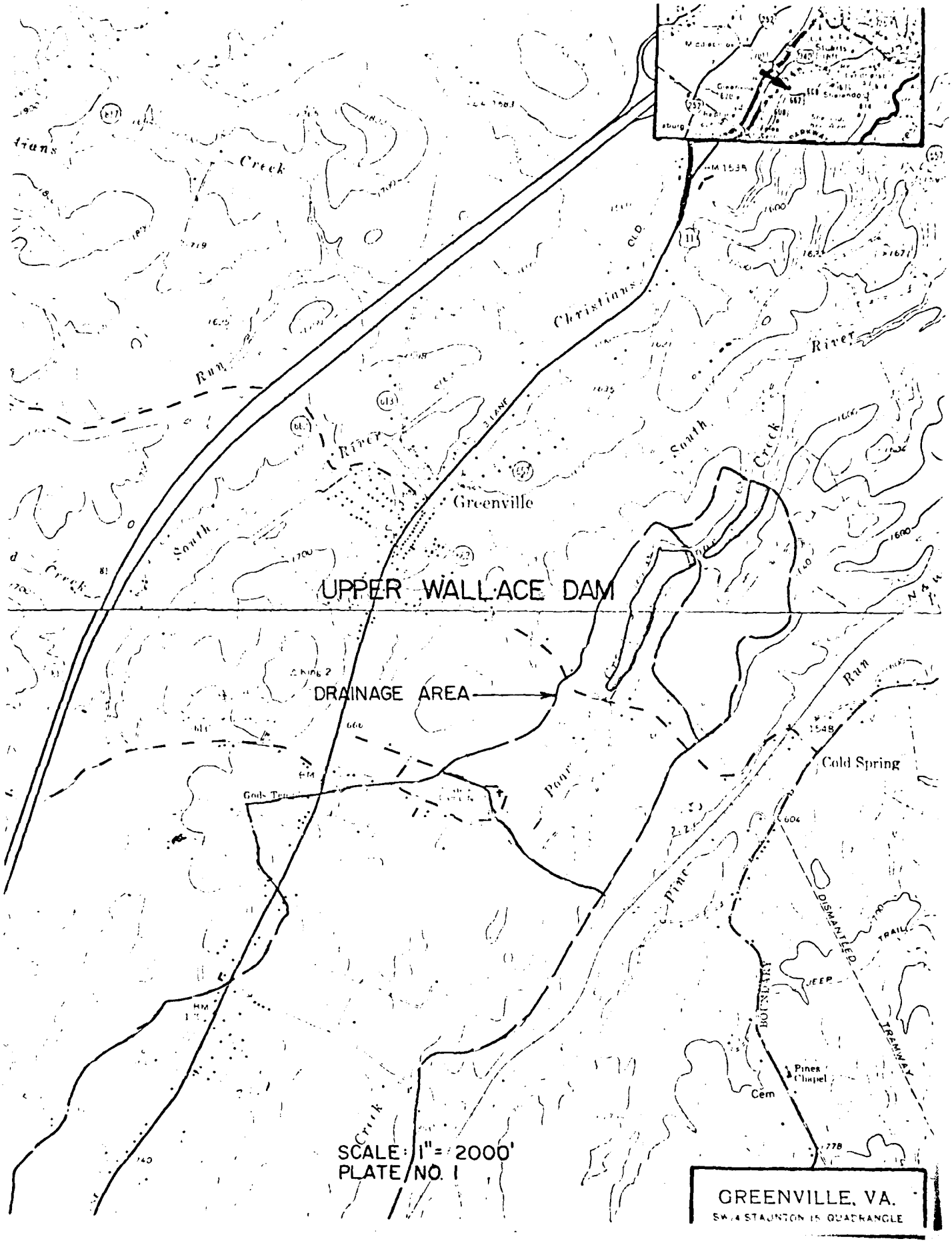
7.3.7 Erosion around the outlet pipe should be corrected.

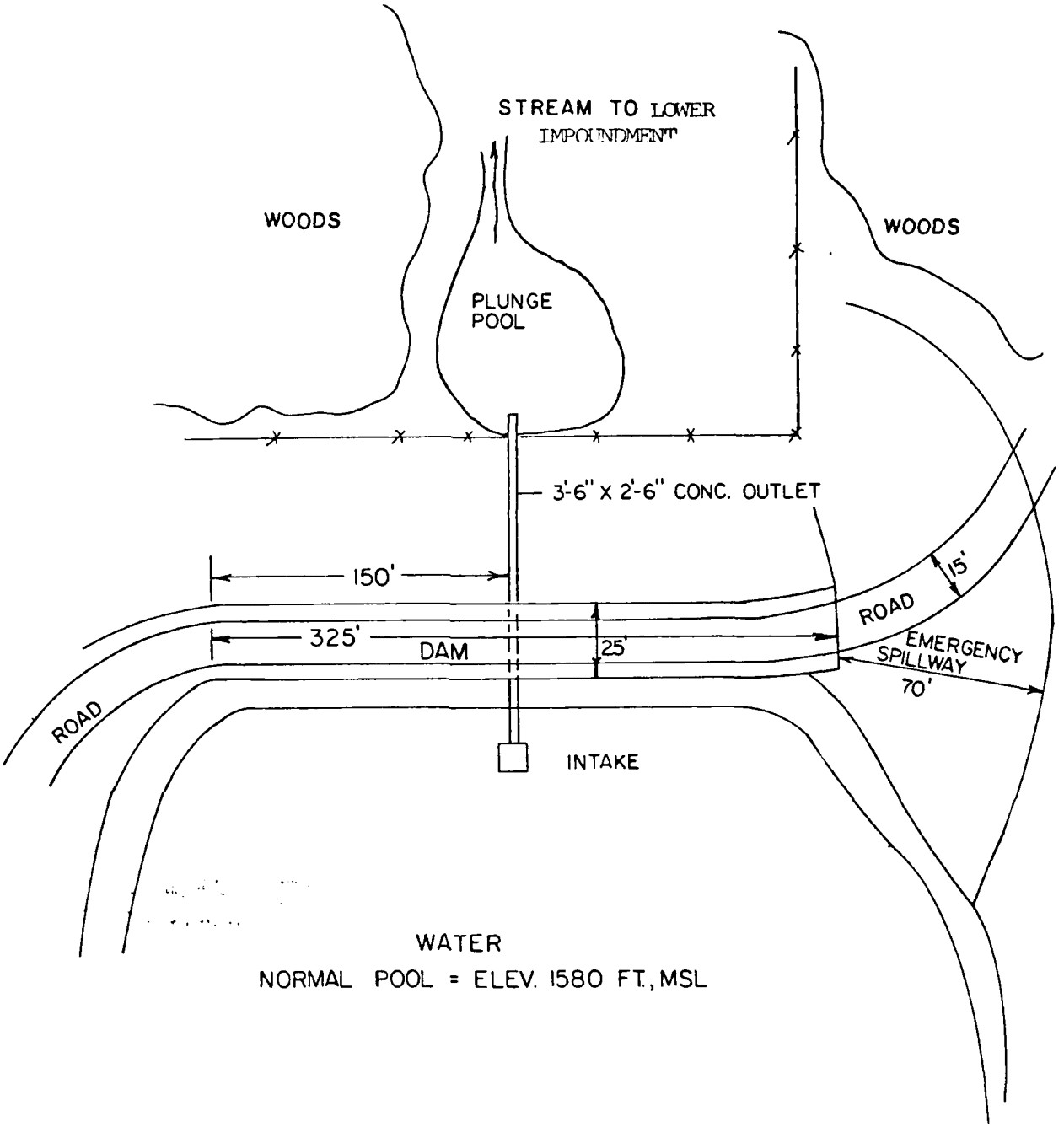
7.3.8 The grass and weeds on the embankment should be cut at least once and preferably twice a year. We would recommend maintenance in the early summer and fall. Small trees should not be allowed to grow on the embankment and should be cut to the ground as they appear.

7.3.9 A staff gage should be installed to monitor water levels.

# APPENDIX I

## MAPS AND DRAWINGS


UPPER WALLACE DAM
DRAINAGE AREA
Greenville
Cold Spring
Pines Chapel
Cem
Trans
Creek
Christians
River
Run
South
Pine
DISMANTLED
TRAIL
JEEP
TRAMWAY
BOUNDARY
SCALE: 1" = 2000'
PLATE NO. 1
GREENVILLE, VA.
SW/4 STAUNTON 15 QUADRANGLE




PLAN

UPPER WALLACE DAM

FIELD SKETCH

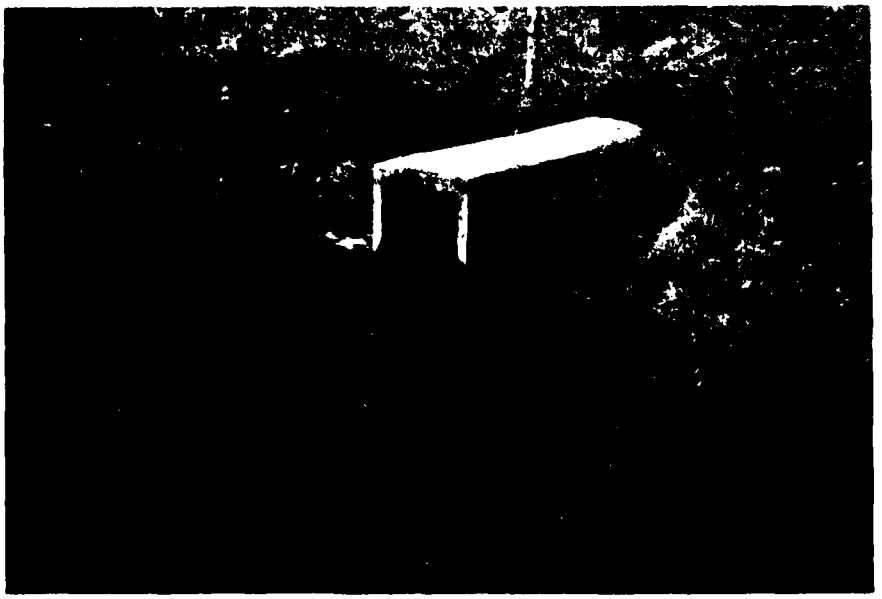
PLATE NO. 2

# APPENDIX II

PHOTOGRAPHS

Downstream Channel and Plunge Pool
(Note Lower Wallace Lake Immediately Downstream)

Photograph No. 1



Outlet Pipe (Note Erosion Around Plunge Pool and Pipe)

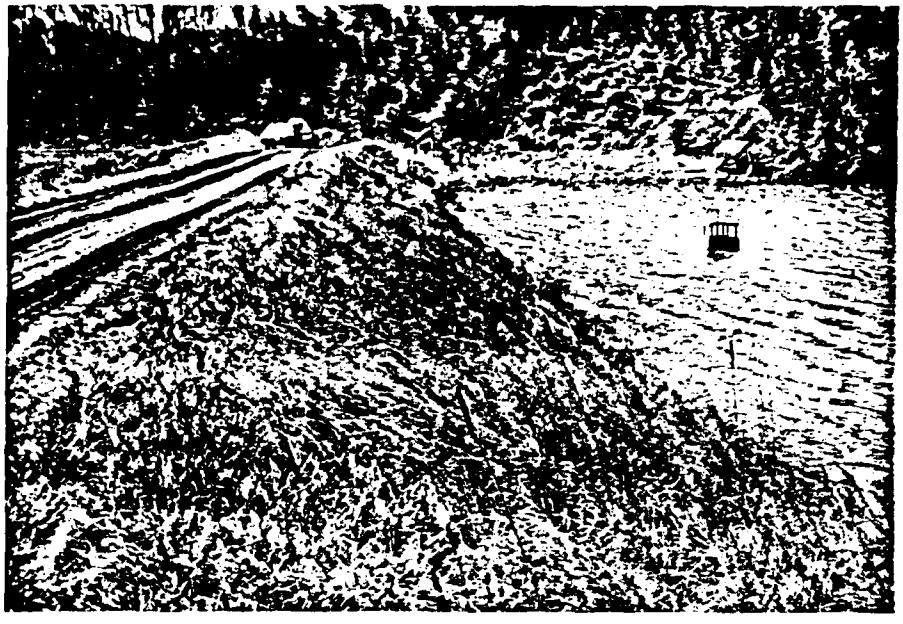
Photograph No. 2

Intake Structure

Photograph No. 3

Emergency Spillway (Note Lack of Vegetation)

Photograph No. 4



Upstream Face of Dam

Photograph No. 5

Downstream Face of Dam

Photograph No. 6

# APPENDIX III

# FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam Upper Wallace County Augusta State Virginia Coordinators Lat 38°-00.1' Long 79°-08.4'

Date(s) Inspection 4/16/80 Weather Cloudy, Windy Temperature 39°F

Pool Elevation at Time of Inspection 1580.5 msl Tailwater at Time of Inspection 1556.2 msl

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Raymond A. DeStephen, P.E.
Stephen G. Werner (recorder)

Gregory Chandler (owner)

J. K. Timmons and Associates, Inc.
Robert G. Roop, P.E.
Donald Balzer (recorder)

State Water Control Board
Hugh M. Gildea, P.E.

## EMBANKMENT

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| SURFACE CRACKS | The slopes, crest, emergency spillway, and abutment contacts were inspected and no cracks were noted. The slopes were grassed and included some cut brush and briars. A dirt to partially gravelled road extends across the crest of the dam. | |
| UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE | None observed. | |
| SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES | Some erosion was observed around the outlet pipe (principal spillway). The downstream slope (1.7H:1V to 2H:1V) was well vegetated and essentially free of erosion. The steeper upstream slope (1.5H:1V) was not as well vegetated and included numerous steeply eroded gullies up to 2 ft in depth. These gullies generally occurred from 3 to 5 ft above pool level down to the lake. One groundhog hole was observed approximately 10 ft below dam crest and 100 ft$^{\pm}$ left of the right abutment. | |
| VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST | Appeared to be good. | |
| RIPRAP FAILURES | No riprap observed other than 6 inch and smaller stone, which were probably incorporated in the fill. | |

## EMBANKMENT

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM | No bedrock was observed at the site. The right abutment and spillway consists of silty clay (CL) with a thin veneer of alluvial/colluvial gravel and boulders. Left abutment consists of fine to coarse sand, trace to some silty clay (SM-SC) with gravel and boulders. The embankment appears to be constructed with SM, SC, and CL soils with varied amounts of gravel and boulders. Local geology appears to consist of alluvial/colluvial soils overlying residual limestone clays and silty clays. No faults were encountered during the inspection. | |
| ANY NOTICEABLE SEEPAGE | Four general seepage areas were observed along the toe of the downstream slope. See accompanying field sketch. | |
| STAFF GAGE AND RECORDER | None observed. | |
| DRAINS | None observed. | |

EMERGENCY SPILLWAY

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| CONCRETE WEIR | None | - |
| APPROACH CHANNEL | Bare earth with 2:1 side slopes at 5% grade to control section channel is 70 ft wide. | Seeding required. |
| DISCHARGE CHANNEL | Overflow is across the access road. This area is vegetated below the roadway. No erosion. | Roadway should be stabilized. |
| BRIDGE AND PIERS | | |

OUTLET WORKS

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT | Concrete rectangular box 2'-6" x 3'-6" | Good condition |
| INTAKE STRUCTURE | Concrete riser inlet 2'-6" x 3'-6"; no indication of deterioration, however, observation was limited due to partial submergence. | Fair condition |
| OUTLET STRUCTURE | Rectangular concrete structure 2'-6" x 3'-6". No deterioration of concrete. | Good condition |
| OUTLET CHANNEL | Rock and grass. Some erosion of banks at plunge pool. | Fair condition. Stone or riprap should be placed around outlet. |
| EMERGENCY GATE | Not operational. | Should be corrected. |

RESERVOIR

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| SLOPES | 2:1 side slopes with no debris observed along perimeter. Dam is located across a wooded valley. | Good condition |
| SEDIMENTATION | None observed. The water is clear. | - |

## DOWNSTREAM CHANNEL

| VISUAL EXAMINATION OF | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| CONDITION (OBSTRUCTIONS, DEBRIS, ETC.) | The channel meanders across open pasture for 500 ft to the Lower Wallace impoundment. Some debris in the channel. Channel width is 5'±. | Good condition, debris should be removed. |
| SLOPES | 3:1 side slopes with 300 ft± wide bottom. | Good condition. |
| APPROXIMATE NO. OF HOMES AND POPULATION | None between outfall and Lower Lake. Several homes 1 to 2 miles below the Lake, approximately 15 ft above channel bed. | A breach in the upper dam would probably cause overtopping of the lower dam. |

INSTRUMENTATION

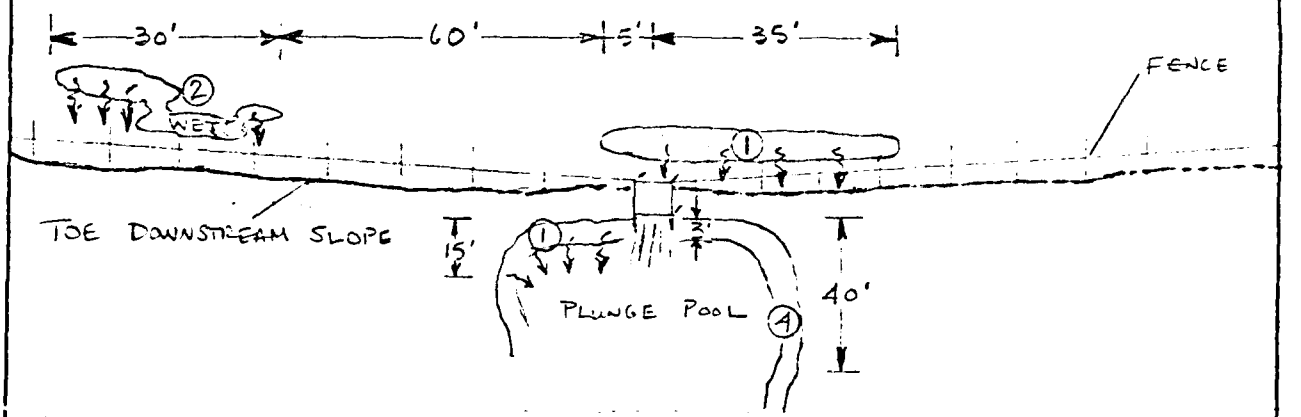
| VISUAL EXAMINATION | OBSERVATIONS | REMARKS OR RECOMMENDATIONS |
|---|---|---|
| MONUMENTATION/SURVEYS | None | - |
| OBSERVATION WELLS | None | - |
| WEIRS | None | - |
| PIEZOMETERS | None | - |
| OTHER | | |

BY SW DATE 4/16/85 SCHNABEL ENGINEERING ASSOCIATES SHEET NO 1 OF 1

CHKD. BY ..... DATE ..... CONSULTING ENGINEERS JOB NO 19010

SUBJECT FIELD SKETCH — SEEPAGE AREAS, UPPER WALLACE DAM

NO SCALE




① SEEPAGE 2 TO 5 FT ± ABOVE TOP OF OUTLET PIPE, SOME IRON STAINING, NO FLOW OBSERVED. GROUND SURFACE ON DOWNSTREAM SIDE OF FENCE ALSO INCLUDES SATURATED AREAS.

② THIS AREA CONSISTS OF TWO WET SPOTS WHICH COALESCE AT TOE OF SLOPE. THE LOWER SATURATED AREAS EXTEND 3 TO 5 FT ± ABOVE THE TOP OF OUTLET PIPE, WHILE UPPER AREA IS ABOUT 9 FT ± ABOVE. NO IRON STAINING OR FLOW OBSERVED.

③ SCATTERED SEEPAGE IN 15 FT ± WIDE AREA ALONG VERTICAL SLOPE, IRON STAINING, FLOW UP TO 1 GPM ±

④ INTERMITTENT IRON STAINING ALONG EDGE OF PLUNGE POOL

## APPENDIX IV - REFERENCES


1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.
2. Design of Small Dams, U. S. Department of Interior, Bureau of Reclamation, 1974, 816 pp.
3. Geology of the Staunton, Churchville, Greenville, and Stuarts Draft Quadrangles, Virginia, Report of Investigations 12, Eugene K. Rader, Virginia Division of Mineral Resources, 1967, 43 pp.
4. Geology of the Vesuvius Quadrangle, Virginia, Report of Investigations 7, H. J. Werner, Virginia Division of Mineral Resources, 1966, 53 pp.
5. Section 4, Hydrology, Part 1 Watershed Planning, SCS National Engineering Handbook, Soil Conservation Service, U. S. Department of Agriculture, 1964.
6. Hydrometerological Report No. 33, U. S. Department of Commerce, Weather Bureau, U. S. Department of Army, Corps of Engineers, Washington, D.C., April 1956.